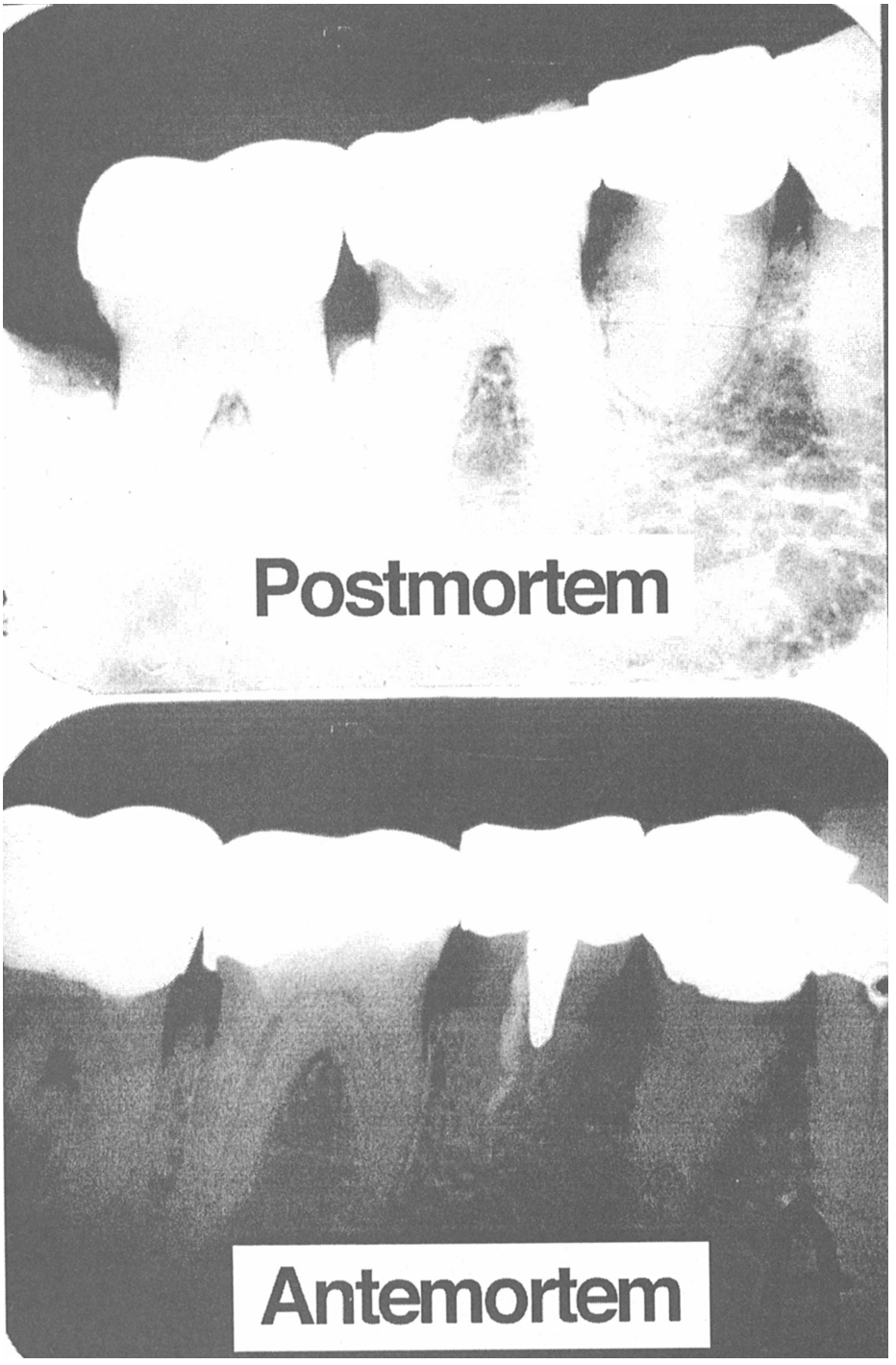


Figure 10-8.—Postmortem and antemortem exact match periapical X-ray.

Similarity

The restoration in the postmortem radiographs is not identical to the restoration seen in the antemortem radiograph. The restorations occupy the same position in the tooth and many similarities in form are present, but there is no exact match. Similarities are caused by differences in the angulation at which the antemortem and postmortem radiographs were exposed.

Relative Discrepancy

A significant difference exists between the restorations in the antemortem and postmortem radiographs. Little or no similarity can be found

between them. However, the difference is explainable by continued treatment and no absolute inconsistency is present.

Absolute Inconsistency

A significant difference between restorations or teeth in the antemortem and postmortem radiographs are presented that are not explainable by continued treatment. In fact, they are found to represent an impossibility in treatment.

CLASSIFICATION OF THE DENTAL IDENTIFICATION

Classification is the last and most important step in the dental ID process. Five classifications can be used to establish identity.

Positive Identification

The forensic dentist is positive they have determined the identity of the individual. Radiographic comparisons have been used in the ID process.

Positive Identification by Charting Only

The forensic dentist feels confident in identifying the individual, but radiographic comparisons have not been used in the ID process. The ID is based solely on the written dental record. This category of ID leaves open the possibility that errors in the written dental record may be present and could affect the ID process.

Consistent With

A good probability is the remains are those of the suspect individual. However, the findings are such that the forensic dentist is not confident enough to certify the remains. In this situation there is usually a deficiency in either the antemortem or postmortem evidence with which to make a comparison. It may also be because of a lack of similarities or because of the presence of too many discrepancies.

Exclusion

Absolute inconsistencies are present. The remains cannot be those of the suspect individual.

Unidentified

No sufficient evidence exists to determine the identity of the remains. While it could possibly be the suspect individual, it could just as easily not be the individual. Additional information, either antemortem or postmortem, is required before an identification can be established.

MANAGEMENT OF MASS CASUALTY OPERATIONS

Although each mass casualty operation is unique in many ways, some basic principles are common to all such missions. First and foremost is recognition that these operations require a **team effort** by all participating parties. Figure 10-9 shows the forensic team receiving a victim to start the ID process.

While many specialty areas may be represented, all must work together and exchange information if the operation is to be a success. For our purposes, we will divide the participants into members of command/support elements or members of identification elements. The command/support elements consist of the following:

- Commander
- Public affairs
- Communications
- Registar
- Data processing
- Security
- Facilities support
- Recovery/transportation
- Storage/handling
- Mortuary affairs
- Graves registration

The identification elements consist of the following:

- In processing
- Photographic
- Personal effects
- Finger/foot print
- Medical radiology
- Dental
- Medical exam/lab
- Anthropology
- Facial reconstruction

THE DENTAL TEAM IN MASS CASUALTY OPERATIONS

Like the other elements of the operation, the different sections of the dental team work together with a common goal. The basic steps in forensic dental identification are (1) postmortem examination and

Figure 10-9.—Receiving a victim.

charting, (2) antemortem record acquisition and record reconstruction, and (3) antemortem and postmortem record comparison. The dental elements of the team are described next.

DENTAL TEAM LEADER

The dental team leader (dental officer) performs the same tasks as the operations chief, only within the confines of the dental team. He brings back information to the dental sections and takes information to the operations commander and other members of the ID operation.

DENTAL REGISTRAR

The registrar is one of the most important members of the dental element because he must control and protect all dental evidence coming into and going out of the dental area. He logs in and out all evidence, antemortem and postmortem, keeps track of workload figures (IDs per day, X-rays taken, photographs made, etc.), and coordinates with other areas of the operation to ensure that all potentially valuable sources of dental information are made available for review by the dental officer or dentist. Figure 10-10 shows a dental registrar updating a forensic tracking board. He makes particular efforts to coordinate with personal effects, medical radiology, and medical examination sections and keeps the operations registrar updated with information the dental section needs. He also maintains and updates the dental exclusion matrix for use at the close of the operation.

ORAL SURGERY

The surgeon's primary job, if needed, is to expose maxilla and mandible so that the postmortem examination team can examine and chart the dental arches. Figure 10-11 shows a maxilla and mandible that have been completely removed from a casualty. This is accomplished by removing tissue from around the oral cavity to expose the teeth, sectioning the ramus of the mandible and the pterygoid muscle to allow the release of the lower jaw. Also, making an incision in the floor of the mouth will release the mylohyoid muscle to ensure an accurate anatomical placement of the dental films. This is made by the Dental Technician who will take radiographs of the appropriate areas.

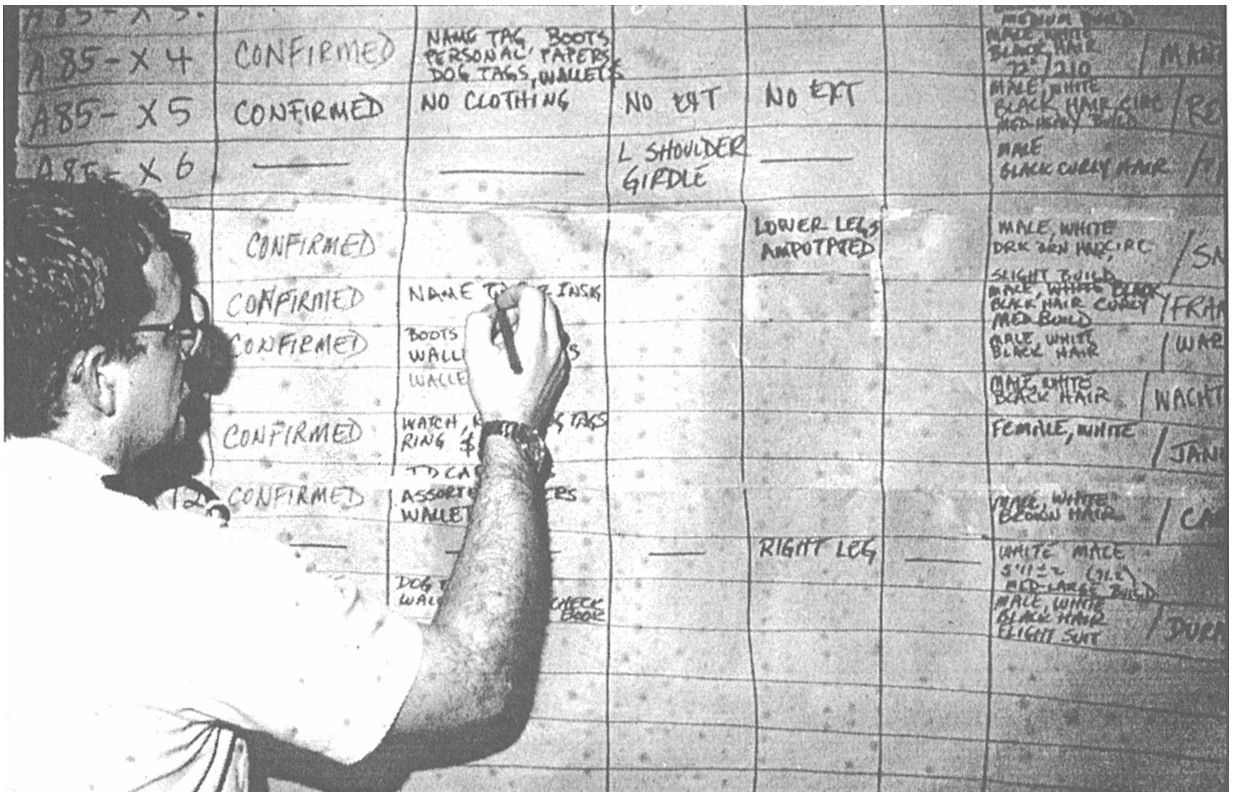


Figure 10-10.—Dental registrar.

DENTAL RADIOLOGY

Postmortem dental radiology plays a critical role in the process of identifying unknown human remains. The procedures used are basically identical to those that would be performed on a living patient, with certain adaptations necessary to each specific situation. The actual exposure of postmortem radiographs poses some special problems that must be recognized and considered to ensure the production of adequate, useful radiographs for comparison with the antemortem dental records. These problems will vary depending on the number of remains to be identified, the condition of those remains, the completeness of the dental structures recovered, and the availability of antemortem dental records. In general, the smaller the total number of remains to be processed, the fewer problems with postmortem radiology. As the number of remains increases, the problems encountered in performing postmortem radiology will increase both in total number and complexity.

Access

Access to dental structures for placement and exposing of the radiographs is entirely determined by the condition of the remains. Normally no problems are associated with skeletalized remains. The lack of soft tissue allows easy visualization for placement of film and angulation. Positioning of the tubehead can also be readily determined and adjusted as needed. The same is true for fragmented remains, which are easily positioned against the X-ray film on a flat surface, as shown in figure 10-12.

Problems with access to dental structures arise most commonly with intact full body remains. This is particularly true if it is a recent death and rigor mortis (stiffing of a dead body) is still present. Opening the jaws more than just a few millimeters can be exceedingly difficult in the presence of rigor mortis. Problems with access are also routinely encountered in individuals killed by fire, because of the loss of flexibility of the muscle fibers as they are cooked in the extreme heat. Drowning victims will also present problems with access to the dentition. If the individual remained in the water for a prolonged period of time, the soft tissues around the teeth begin to swell with fluid and thereby obstruct accurate film placement. When access to the dentition for postmortem dental radiology is a problem, the dental officer will be able to assist you with proper access.

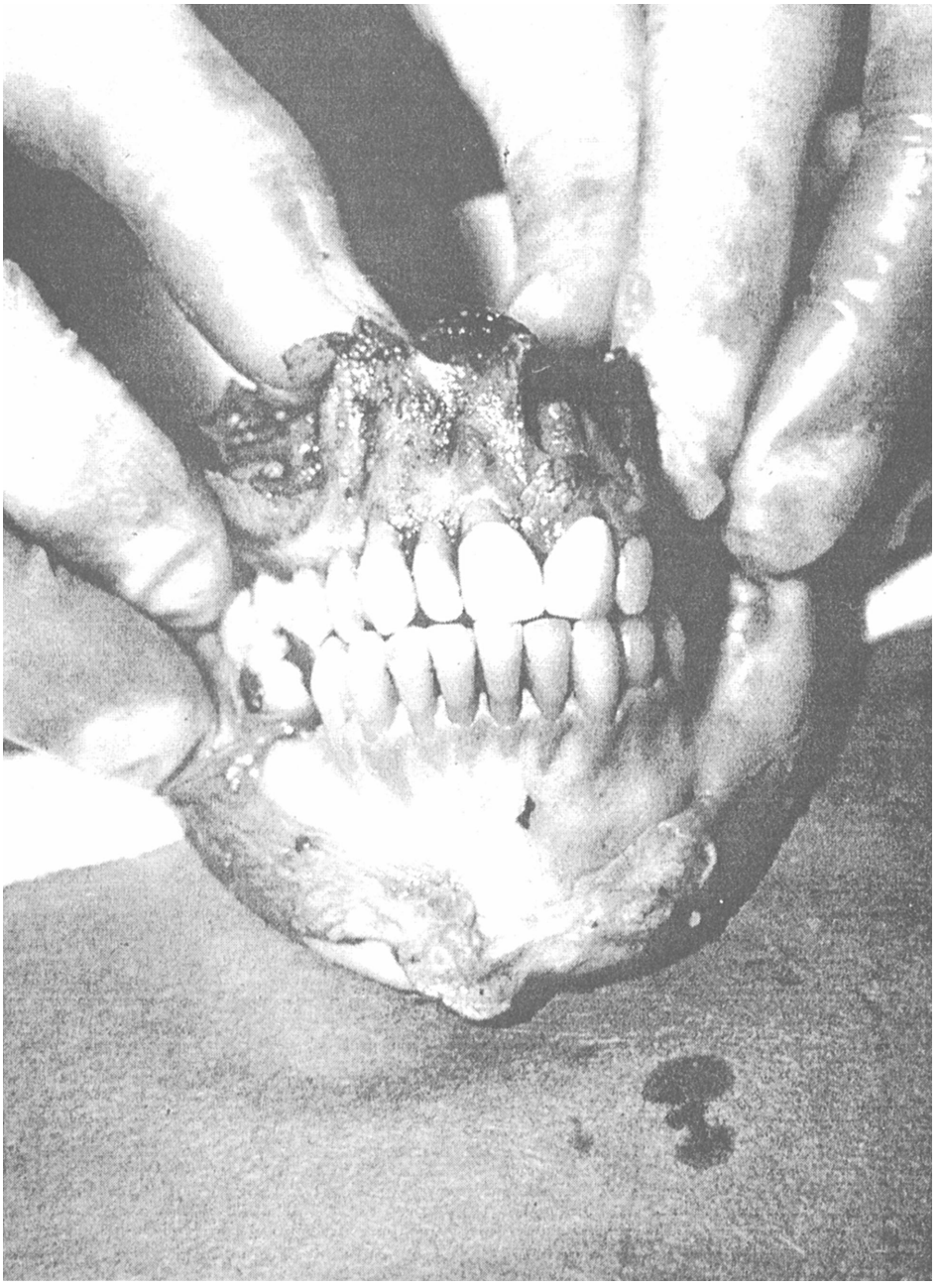


Figure 10-11.—Exposed maxilla and mandible.

Equipment

In small operations with minimal number of remains to be processed, equipment is not a major consideration. However, as the number of remains increases, the availability of equipment becomes a major determining factor in the efficiency of the dental Id section. In situations where hundreds of remains require ID, you should have as many X-ray machines available as possible to speed up the initial processing of the remains. Postmortem radiographs are obtained from regular floor-mounted, mobile endodontic, and portable military field types of dental X-ray units.

Exposure of Postmortem Radiographs

The forensic X-ray section must realize that exposure of postmortem dental radiographs is the time limiting step for the dental ID section as a whole. It will normally require approximately 20 minutes to expose a complete series of postmortem radiographs. Therefore, a maximum of 3 sets of remains per hour can be processed with a single X-ray machine. Careful

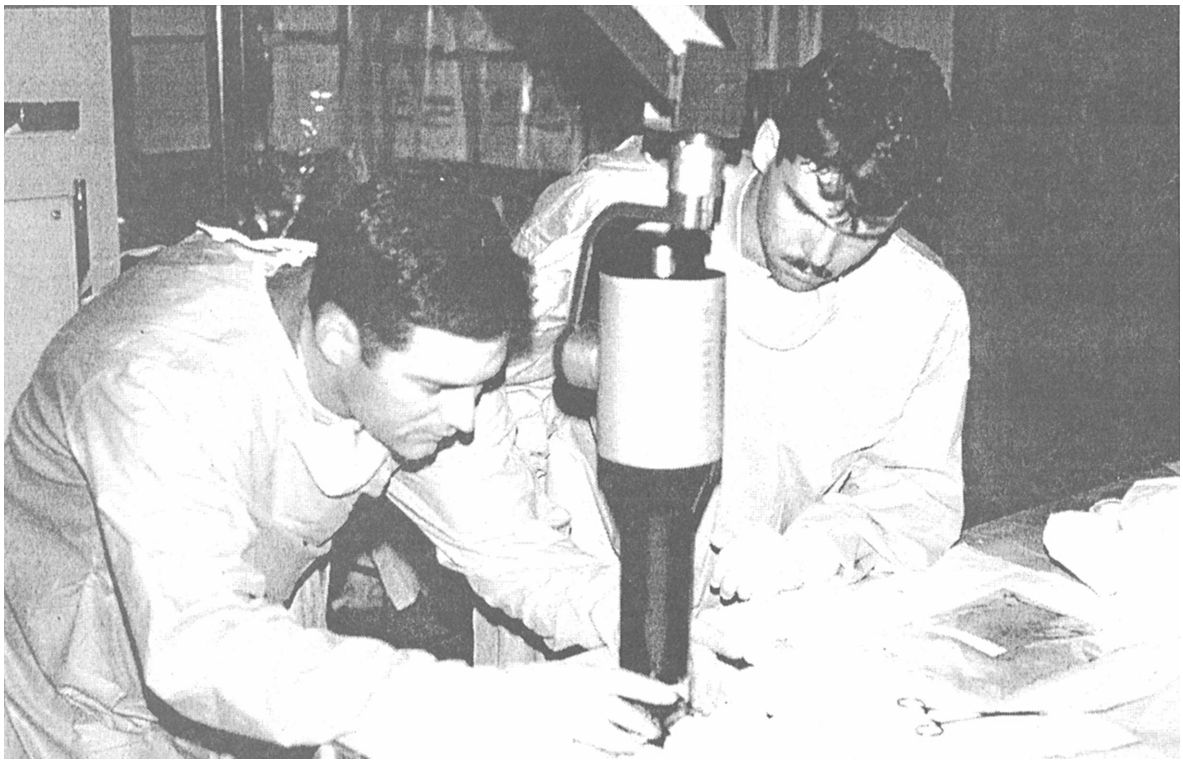


Figure 10-12.—Positioning dental fragment on X-ray film for exposure.

planning is required to prevent confusion in the flow and tracking of the remains as they are processed.

The dental radiology section's job is to get, as nearly as possible, a full mouth series of periapical radiographs. On occasion, the forensic dentist may request occlusal and lateral jaw films. The proper technique to use is to expose of the films in the proper anatomical orientation to prevent overlap, shorting, or elongation of exposed dental films. This is necessary because the postmortem films will be compared with the antemortem films that were exposed on a live patient using appropriate anatomical placement and angulation. Always expose a full mouth series using duplicate film packets even if areas appear edentulous or teeth are missing, fractured, or avulsed. Shoot different films at several angles and take care to expose all fragments in their proper anatomical orientation. It may not always be easy to take X-rays of teeth because postmortem dental remains may be fractured. The following supplies may be needed to assist you in exposing radiographs: hemostats, gauze, clay, and rope wax.

Developing

Any X-ray developer can be used to process radiographs. The use of a daytime loader is recommended to speed up the process. When multiple remains are being processed at the same time, the following procedures are normally prescribed.

- The entire series of postmortem radiographs is exposed before any has been developed.
- The series is placed into a labeled carrying container for transport to the developing area.
- Each series is developed at a single developing site or machine. Films from one series are never separated from one another for developing.

Mounting

In forensic dental operations, it is not important which method is used for mounting periapical and bitewing X-rays, as long as the method selected is uniform. The raised dot on the film can be facing in or out. All postmortem radiographs should be mounted in the same manner so there will be no confusion by the examiners as to which side is which. The policy should be well publicized so that everyone working in the dental ID section, not just those in the dental radiology subsection, are aware of the standard.

FILM ACCOUNTABILITY.—One primary area of concern is the ability to determine, at any point

in time, if a film is missing from the film mount. This might occur because of its falling out of the mount or because an examiner has purposefully removed it for some reason. When dental evidence is incomplete and a complete series of postmortem radiographs has not been taken, there are two methods by which the examiners know for sure what films are available for their use. The first, and best method, is to fill all holes in the mount with undeveloped, unexposed film once all films from a set of remains are developed. An examiner who picks up a mount will immediately notice the green, opaque films in the mount and realize that no radiograph is available for this particular area. If an empty space is present in any of the mounting slots, the examiner immediately knows that a film was taken out of this site. The second method is to maintain a written inventory list of postmortem films exposed on each set of remains.

ELIMINATION OF ERRORS.—A routine mounting procedure is quite useful and involves taking the following actions:

- Have one viewbox per developer and co-locate them so that loss of films in transport from developer to viewbox is not possible.
- Use viewboxes that can be laid flat to prevent dropping of films.
- Orient all dots in the correct position.
- Orient the entire series as it will appear in the mount before actually mounting any films.
- Remember whatever is in the center of the film determines its position in the mount.
- Have all series reviewed by a dental officer or a dentist at the postmortem examination station for correctness in mounting.

DENTAL POSTMORTEM EXAMINATION

The postmortem examination team you may be on is responsible for examining and charting the dental remains to include the presence or absence of teeth, restorations, pathology, and any other feature that might be useful in the ID process. Figure 10-13 shows a forensic dental examination of a casualty.

The process starts with gentle cleaning of the dental remains with a tooth brush using sodium hypochlorite (bleach) and hydrogen peroxide. Remember that incinerated (burnt) teeth are brittle and will shatter if not handled carefully. Next, a team process including either a team of three dentists or a team of two dentists and a dental hygienist or a Dental Technician, chart all dental evidence on a postmortem dental record form. Figure 10-14 is an example of a completed postmortem dental record form.

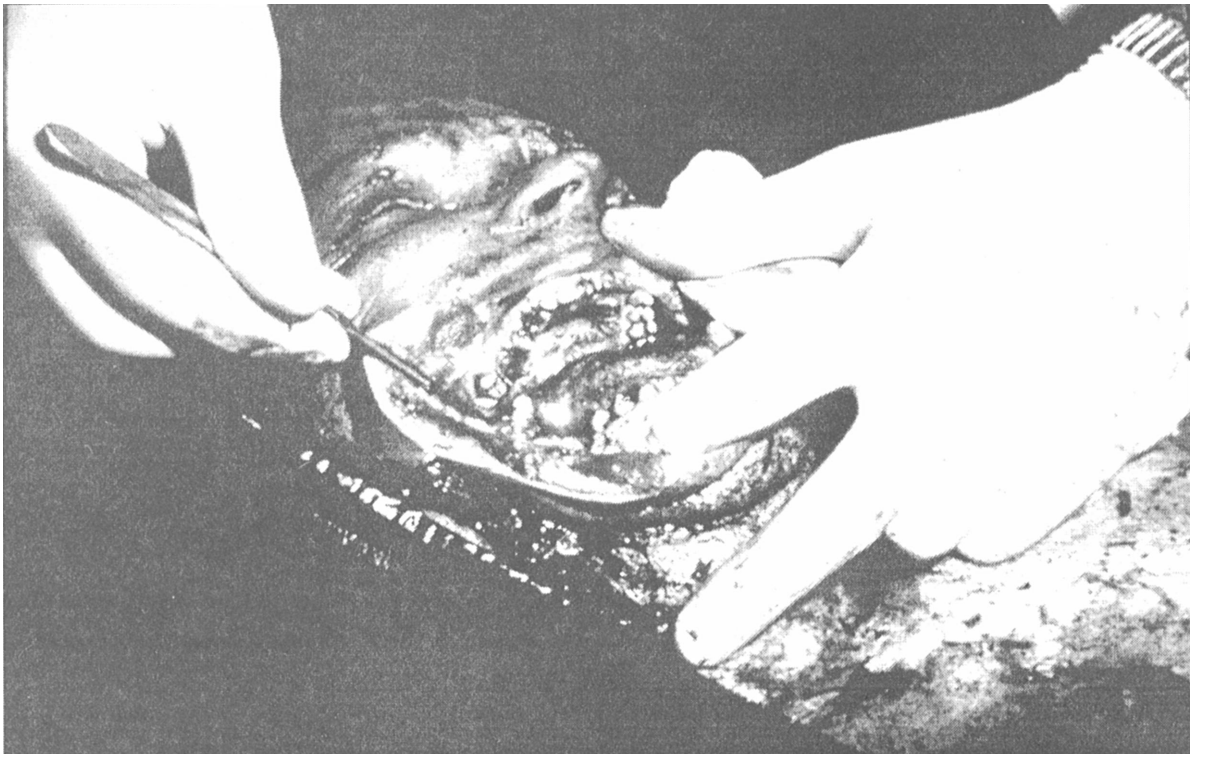


Figure 10-13.—Forensic dental examination.

POSTMORTEM DENTAL RECORD

RECOVERY NUMBER A-97-3 EST. AGE: UNK RACE: UNK SEX: UNK DATE: 12 DEC 97

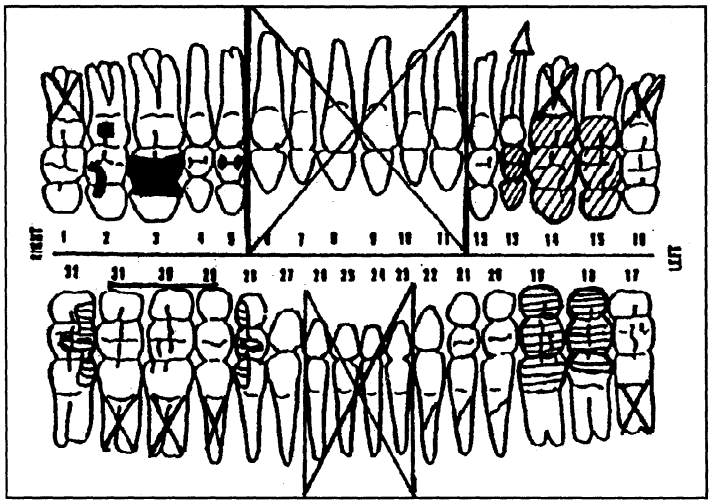
EXAMINERS: A. B. SMITH, CAPT, DC, USN P. T. BOATS, CDR, DC, USN

PLACE OF EXAMINATION: NAVAL AIR STATION, PENSACOLA, FL

DESCRIPTION/COMPUTER CODES

1. X
2. OL-AM ; F-AM
3. MODL-AM
4. PN
5. O,O-AM
6. JM
7. JM
8. JM
9. JM
10. JM
11. JM
12. PN
13. FP-CV , RF-AP
14. FP-X
15. FP-CF
16. X
17. X
18. CP
19. CF
20. FX
21. FX
22. FX
23. TA
24. TA
25. TA
26. TA
27. PN
28. DOFL-GI
29. RP-X
30. RP-X
31. RP-X
32. MOFL-GI

RESTORATIONS & MISSING TEETH



CAPMI SYMBOLS

AM	AMALGAM	CF	CROWN FULL
GI	GOLD INLAY	CP	CROWN PARTIAL
GF	GOLD FOIL	CV	CROWN VENEER
SS	ANY OTHER METAL REST	FP	FIXED PARTIAL
CO	COMPOSITE RESIN	RP	REMOVABLE PARTIAL
JM	JAW FRAGMENT MISSING	CD	COMPETE DENTURE
TA	TRAUMATIC AVULSION	M	MESIAL
FX	FRACTURED CROWN	D	DISTAL
RT	ROOT TIP	O	OCCLUSAL
PN	PRESENT NOT RESTORED	I	INCISAL
RO	ROTATED	F	FACIAL
RF	ROOT CANAL FILLING	L	LINGUAL
AP	APICOECTOMY	C	CARIES
IR	INTERMEDIATE REST	U	UNERUPTED
CT	CROWN TEMPORARY	X	EXTRACTED

REMARKS: BILATERAL MANDIBULAR TORI

DTV2f014

Figure 10-14.—Completed postmortem dental record form.

The entire dental team must agree to be consistent in charting methods. This is a slow process and much attention must be paid to details. Remember to check and double check each step. The team will decide which charting system they will use. The different branches of the service and civilian dentists all use different charting systems and abbreviations. The *Manual of the Medical Department,* chapter 6, describes the Navy's charting system and abbreviations used to complete all dental information for the different forms used in forensic dentistry. Other dental abbreviations used for charting, such as the Computer Assisted Postmortem Identification, may be used and will be covered later in this chapter under Computer Support. The use of a fiberoptic light is invaluable in the examination process. The examiner begins by evaluating tooth #1 and associated radiographs. The second dentist on the examination team evaluates tooth #1 and confirms the findings of the first dentist. The recorder charts the findings of tooth #1 and all three members confirm the charting. Tooth #2 is examined and the process is repeated until all 32 teeth have been charted. The approach is redundant, but errors are corrected as they are made. Charting should be done in pen, not pencil. Findings to be recorded during the postmortem examination are as follows:

- Dental restorations
- Missing teeth
- Prosthetic appliances
- Pathology
- Unique anatomy
- Age estimate
- References to possible gender and racial group

Teeth missing because of the trauma of the mishap should be specifically noted to avoid confusion over extracted or congenitally missing teeth. A prosthodontist should be available to examine and describe dental prosthetic appliances. In some cases, the appliance may have been specifically marked for identification as shown in figure 10-15. It is wise to solicit from the victim's family study models or extra prosthetic appliances that may be available. Such evidence is important in providing antemortem data regarding ridge shape/size, rugae, and general oral anatomy. The antemortem dental record will be covered next.

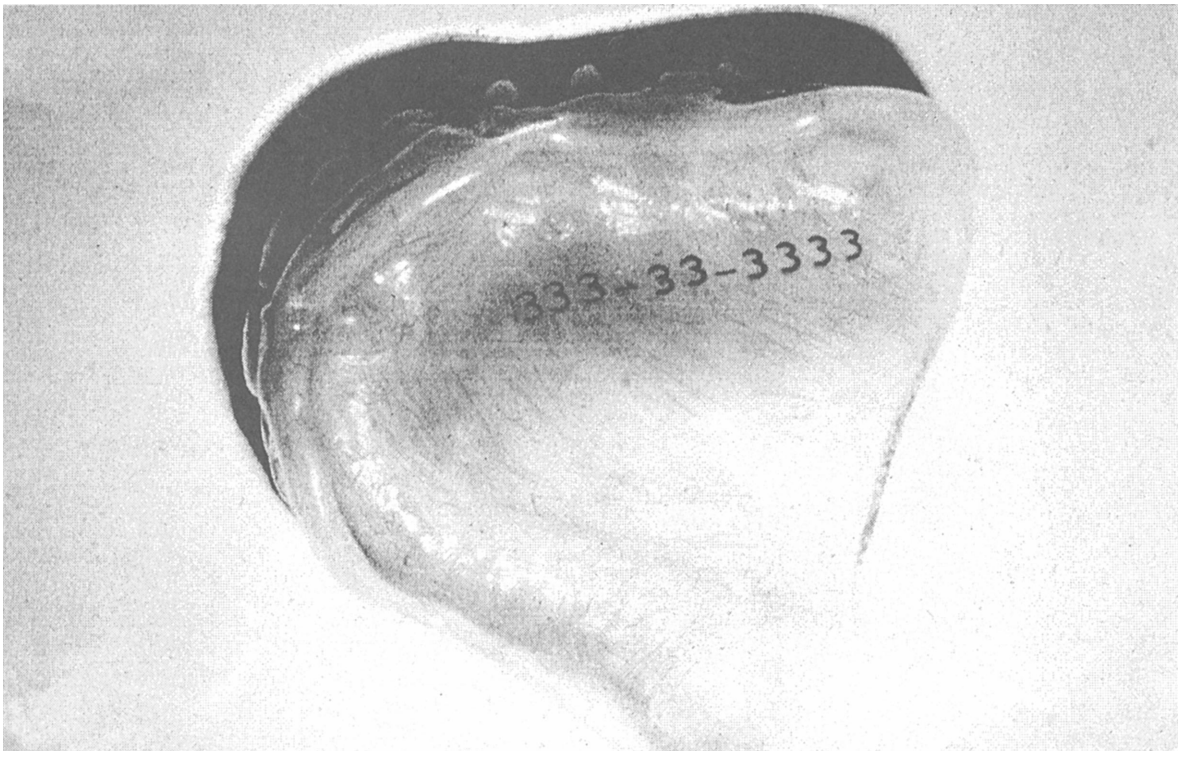


Figure 10-15.—Maxillary denture with SSN embedded in acrylic.

ANTEMORTEM DENTAL EXAMINATION

Another major section in forensic dentistry involves the antemortem dental record examination. Dentists, hygienists, and Dental Technicians can effectively operate this section. The task of this section will always be the most difficult in the entire forensic dentistry arena. They will be required to determine who was involved in the disaster, locate and procure all military or civilian dental records and radiographs, arrange for the delivery of these materials, and undertake the process of developing a composite antemortem record for each victim for the evidence supplied. You may not have all existing antemortem dental records for the victim from outside sources. This may lead to discrepancies in the antemortem record and postmortem record comparison. The quality, quantity, and variety of dental record documentation of this antemortem evidence present the major obstacles in this section. Clearly, all antemortem evidence must be compiled to a single antemortem dental record form as shown in figure 10-16, to provide a composite antemortem picture. The latter (computer/description codes column) may be easily compared to the postmortem findings recorded on a postmortem dental record of similar format. Comparing dental records sent directly from dental offices with a postmortem record is a near impossible task. At least two members of the antemortem dental record staff should review each composite antemortem dental record as a quality control mechanism. Figure 10-17 shows a dental staff reviewing antemortem dental records. The completed antemortem composite form should also be quality checked against antemortem dental radiographs.

COMPUTER SUPPORT

In this day of data management and word processing, computers can now play a major role in forensic dental ID. The software we use is called the Computer Assisted Postmortem Identification (CAPMI) referenced in figure 10-18.

The basic principle is one in which antemortem and postmortem databases are built using the information charted on the antemortem and postmortem forms. These two databases are run against each other and the possibilities of matches are ranked to produce a most likely identities list. This list is then used by the forensic team to assist in the final ID process. The list does not make an ID, but merely minimizes the number of records that must be compared manually by the team. The advantage is that, instead of having to look at every record to make a comparison, the dental officer or dentist who is reviewing the record is initially guided to the most likely match. This is tremendously efficient and offers a significant savings in time. CAPMI may be installed either on a portable or desktop computer. Your command can obtain copies of CAPMI software and instructions free of charge by writing to the following address:

The Director
Armed Forces Institute of Pathology
Attn: AFIP-AMS
14th & Alaska Ave, NW
Washington, DC 30306-6000

ANTEMORTEM/POSTMORTEM RECORDS COMPARISON

The last section in the dental forensic ID process compares the antemortem and postmortem records. Here the results of all previous work are seen. Armed with the antemortem record and radiographs, postmortem record and radiographs, CAPMI printout (if used), and a summary sheet, the forensic team starts the process of comparing records and films. The size of the section is dependent on the number of fatalities, since there is a requirement to place all postmortem dental records face-up on tables in numerical order for a comparison with the antemortem composite dental records, as shown in figure 10-19.

After all postmortem dental records have been placed as described, the staff can systematically compare- the antemortem dental composite records as they are received with the postmortem dental records placed on the table. This is done by hand carrying the composite antemortem record and walking alongside the tables viewing the postmortem dental records looking for a significant point of comparison, such as a crown on tooth #30. Once significant points of comparison are noted between the antemortem and postmortem dental record forms, the radiographs of the respective records can be reviewed and a possible match established. Figure 10-20 shows dental team members reviewing radiographs.

If it is possible to determine the gender of the disaster victims, it is possible to reduce the manual comparison task by placing the postmortem records in